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# Toxicological Assessment of Commonly Used Plastics

**MD ABDUR RAFEEQ and S.R RATHNAM**

Dept of Chemistry, Girraj Govt. College Nizamabad A.P.

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**ABSTRACT**

Plastic materials are commonly used for storing food stuffs and medicines. Chemical substances used in the manufacture of plastic goods are found to migrate in the food stuffs used. The migration of UV absorbents and oxidisable matter was found to be more when used for longer periods.

**Key words:** Toxicity, global migration, leachants.

## INTRODUCTION

Production and application of plastics has increased several folds during the recent years, Plastics are widely used in household, hospitals, agriculture, automobiles, industries and buildings. Plastics are organic polymers, known to be biologically inert and posses no toxic effects, if they are used properly and manufactured using the standard chemicals recommended by national and international regulatory agencies. How ever some of the chemical components of plastics such as plasticizers , stabilizers, heavy metals, UV absorbers and unreacted monomers have been reported to be toxic and may leach out from finished plastics into stored commodity. Some times the stored commodities in these plastics for longer time are found to get peculiar odours and colours due to leaching from finished plastics into the stored commodity.Different countries depending upon their requirement have laid down safety evaluation tests for plastics to be used in storage and packaging of food products.

The present study is intended to evaluate the safety of plastics available in local market being used for various purposes. This evaluation will in the safe use of plastics and prevent the toxicity.

## MATERIAL AND METHODS

About 5 samples of plastics of various brands which come in direct contact with food and drinking water were procured from the market of Nizamabad. The plastic samples were thoroughly washed with tap water and finally with distilled water.

The extracting media and the test conditions are based on the recommendations of Bureau of Indian standards. The actual methods have been slightly modified to meet the local standards and availability of the resources.

**Extracting media**
Double distilled water
Ethyle alcohol 8%( v/v0

Acetic acid- 3% ( w/v)
Sodium carbonate- 55 ( w/v)

**Test conditions**

1. 60 C for 10 days: Plastics used for food for long term contact.
2. 60 C for 2 hours: Plastics used for short time contact.

The cleaned and dried plastic materials of various selected brands were cut into 5 x 0.3 cm 3 surface area was extracted with 1ml of extractant, Control extractants were run parallel in the identical conditions without the plastic strips. All the samples were tested in triplicates.(Ala metal, 1988)

Tests conducted in all extractants were for Physical state, Clarity of colour, Global migration, oxidisable matter and UV absorbents.

Physical state and colour was assessed by observation. UV absorbing components in the extractants were determined using UV Spectrophotometer. The extracts were scanned between 220nm to 400 nm. Results were expressed as per the difference in optical density obtained from the plastic extracts and the blank. ( Controlled) ( WHO 1974) The test for oxidisable matter was conducted by titration method. ( BIS 9845:2, 1976) Global migration of the substances was tested by gravimetric method.

## RESULTS AND DISCUSSION

The values obtained have been shown in tables.

The extracts of all the brands were free from odour except water carrier. The change in colour was obtained in Local brand Lunch boxes. The UV absorbing materials were found above the permissible limits in all the brand used for long term contact only, but for short term usage only the brand C and Local brands showed the UV absorbing materials above the permissible limit. The global migration from plastic samples under the different test conditions showed astonishing facts, The short term migration of chemical additives was found to be above the permissible limit. In water and Ethanol extracts the migration was within the permissible limit where as in 3% acetic acid and Sodium carbonate extract the migration was found to be above the limit. Thus it is found that the degree of leaching was high in basic and acidic solutions. In long term contact study of 60 C for 10 days all the samples tested showed the overall migration above the permissible limits in the extracts of 5% Sodium carbonate and 3% acetic acid. This was mostly found in Lunch boxes. The values in other extracts were just at the permissible limits The leaching of oxidisable matter is mostly affected by alcoholic nature of extractants, and the values were within the permissible limits for all other extractants. In long term contact study, 8% ethanol and 3% acetic acid

**Tables**

**Global migration from various brands of plastics in Various extracantsat 60 c for 2 hrs**

| Plastic Sample | Distilled Water | 8% Ethanol | 3% Acetic Acid | 5% SODIUM Carbonate |
|---|---|---|---|---|
| Mug | 3.4 +0.17 | 2.1 + 0.11 | 4.3 +0.13 | 5.5 + 0.20 |
| Tumbler ( Brand A) | 3.8 + 0.29 | 2.9 + 0.10 | 6.4 +0.41* | 7.1 + 0.14* |
| Tumbler ( Brand B) | 2.4 + 0.11 | 1.8 +0.10 | 2.7 +0.06 | 5.2 + 0.10* |
| Lunch Box (BrandA) | 2.7 + 0.11 | 1.4 +0.04 | 4.1 + 0.12 | 6.4 + 0.21* |
| Lunch Box (Brand B) | 3.4 + 0.17 | 3.0 + 0.16 | 7.1 + 0.13* | 8.3 + 0.20* |

Results in mg/100 ml of extract
above than the permissible limit *
Values are mean $\pm$. S.E of four samples
Permissible limit: Global migration should not be more than 5.0 mg/100 ml of extract.

showed the enhanced rate of migration oxidisable matters for all the brands of plastics.

Therefore the manufacturers are advised to synthesise plastic commodities as per norms of the regulatory authorities. The present study suggests that the plastic material should be used only for those purposes for which they have been designed and tested. Otherwise the possibility of health hazards to the consumers of plastics exists if non food grade or untested plastics are used, since some of the leachants have toxicogenic

**Global migration from various brands of plastics in various extracants at 60 c for 10 days**

| Plastic Sample | Distilled Acid | 8% Ethanol | 3% Acetic Water Carbonate | 5% SODIUM |
|---|---|---|---|---|
| Mug | | | 5.8 + 0.08* | 4.1 + 0.17 |
| 12.5 +0.23* | 11.1 + 0.23* | | | |
| Tumbler ( Brand A) | 6.3 + 0.17* | 5.6 + 0.24* | 12.8 + 0.13* | 15.7 + 0.21* |
| Tumbler ( Brand B) | 4.9 + 0.10 | 10.1 + 0.23* | 13.2 + 0.25* | 5.2 + 0.10* |
| Lunch Box (BrandA) | 6.3 + 0.19 * | 8.4 + 0.19* | 13.4 + 0.34* | 17.1 + 0.23 |
| Lunch Box (Brand B) | 6.1 + 0.14* | 6.8 + 0.13* | 9.9 + 0.21* | 12.0 + 0.15* |

Results in mg/100 ml of extract above than the permissible limit *
Values are mean $\pm$. S.E of four samples
Permissible limit: Global migration should not be more than 5.0 mg/100 ml of extract.

**Migration of uv absorbers from various brands of plastic Samples in different extractants kept at 60 c for 2 hrs**

| Plastic Sample | Distilled Acid | 8% Ethanol | 3% Acetic Water | 5% SODIUM |
|---|---|---|---|---|
| Mug | 0.088 | 0.08 | 0.08 | 0,04 |
| Tumbler ( Brand A) | 0.091 | 0.04 | 0.05 | 3.5* |
| Tumbler ( Brand B) | 0.05 | 0.36 | 0.07 | 0.05 |
| Lunch Box (BrandA) | 0.03 | 0.24 | 0.24 | 0.25 |
| Lunch Box (Brand B) | 0.02 | 0.45* | 0.05 | 0.25 |

Permissible limit: Optical density should not be more than 0.3

**Migration of uv absorbers from various brands of plastic samples in different extractants kept at 60 c for 10 days**

| Plastic Sample | Distilled Acid | 8% Ethanol | 3% Acetic Water | 5% Sodium |
|---|---|---|---|---|
| Mug | 0.23 | 0.45* | 0.65* | 0.79* |
| Tumbler ( Brand A) | 0.22 | 0.56* | 0.67* | 0.75* |
| Tumbler ( Brand B) | 0.20 | 0.54* | 0.78* | 1.02* |
| Lunch Box (BrandA) | 0.28 | 0.76* | 0.85* | 1.25* |
| Lunch Box (Brand B) | 0.29 | 0.85* | 0.99* | 1.30* |

Permissible limit: Optical density should not be more than 0.3

potential. In our country plastic utensils containing pickles, fruit juices, curd, milk etc. are often exposed to sunlight and some times to elevated temperatures during their packaging and transportation, and under such conditions the heavy metals migrate from plastic packaging materials into stored commodity which may have many toxic effects. So precautionary measures should be taken by consumer as well as manufacturers to avoid the health risk, during the use of plastic materials. The data presented through this project is of immense importance and significance as may serve as a base line for formulating the guidelines for the safe use of plastics. It is also suggested to use paper as an alternate of plastic as it is bio degradable.

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